

The Perspective of the Automotive Industry on Sustainability: Case of Kütahya*

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Abstract

Nowadays, the concept of sustainability, which has become one of the important and common concepts in economic and social fields and especially in the environmental science, is defined in the Brundtland Report (1987) as meeting the present needs, in such a way not to jeopardize the meeting of the needs of future generations (Nuong et al., 2011: 43). Sustainability, which has been considered as one of the professional business activities in recent years, often takes place in the strategies of businesses that are leaders in the world and are trying to achieve this goal. In this respect, sustainability, which has been just included in the agenda of the businesses in our country, constitutes the subject of the study. Based on the automotive industry, which is vital for the national economy, it is aimed to examine the perspective of production businesses operating in Kütahya in this industry on sustainability and to reveal the perception of sustainability in the businesses. The economic, social, and environmental dimensions of sustainability in the literature and the subcomponents of these dimensions are analyzed by one of the multi-criteria decision-making methods, the Analytical Hierarchy Process, based on the sustainability model developed by Salvado et al. (2015). This study is thought to be important in terms of increasing the awareness of sustainability, which has a major impact on global and local competition, as well as being important and primary in meeting the responsibilities of businesses to the society and environment, adopting, applying, and extending the applications in our country. It is hoped that this application study in the automotive industry will also contribute to the activity force and businesses of the country in terms of its contribution to the national economy and its intense relationship with other industries.

Keywords: Sustainability, Indicators of Sustainability, Analytic Hierarchy Process, Automotive Industry

1. Introduction

Sustainability is the concept, of which importance has been the most discussed in the last few decades. Deteriorations in the world ecological system and serious issues show that the future of mankind is under threat. According to the last data of the World Wide Fund for Nature, people living in the world use resources as if there were 1.7 worlds. In other words, despite the increase of the population, the demand for resources and the growth of economies, the size of the world and the amount of resources do not increase (http://www.wwf.org.tr/basin_bultenleri/guncel_haberler/?7020/bugunden-itibaren-dogaya-borcluyuz). On the contrary, the uncontrolled use of resources leads to the problem of the decrease in quantity and extinction. This destruction of the natural environment forms the starting point of the concept of sustainability. However, this cannot be limited only to the natural environmental problem nowadays. While a decrease in resources triggers the resource allocation problem, it causes social inequality and thus deteriorates the economic welfare level for some countries and societies. In this context, sustainability contains a holistic perspective, in which environmental, social, and economic dimensions are interrelated with one another, and any positive or negative situation occurring in one of them creates a change in others. According to this holistic perspective, sustainability can be expressed as the controlled use of resources from now on so that future generations can live in equal conditions and welfare. According to the definition, businesses that provide the conversion of resources to goods and services for human needs are an important factor in ensuring sustainability. In particular, the fact that the destruction experienced in the natural environment is closely related to the historical development of the industry reveals the importance of businesses for sustainability. In this context, the perspectives and practices of businesses in countries on sustainability are effective in terms of the future generations' rights to live.

The important and prioritized thing in sustainability, which is a comprehensive and uninterrupted action process with the vision of the future, is to discuss its impacts and extensions on the society, public and private sectors, and to make plans accordingly. The automotive industry, which has an intensive relationship with many sectors and a wide economic chain, has a great impact in many areas of sustainability, especially in the social, economic, and natural environment. In this respect, the perspective of the automotive industry, which is among the industrial sectors having a great share in sustainability and sustainability-based development, which has been one of the important strategies in recent years, is examined in the study.

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In the forthcoming sections of the study, following the explanation of sustainability with its theoretical framework, the Analytic Hierarchy Process method among multi-criteria decision-making methods is examined in detail. In the next section, the application study on businesses operating in Kütahya organized industrial zone and automotive industry is mentioned. The findings obtained from the study and recommendations are given in the conclusion.

2. The Theoretical Framework of Sustainability

The historical event that can be considered to be the most important stage in the development of technological, socio-cultural, and economic changes that we experience nowadays is the Industrial Revolution. While the Industrial Revolution created a new social order, it laid the groundwork for the emergence of problems in the ecosystem, and with this issue, an irreversible process began as a result of the destruction created in the ecosystem by the developments experienced in the 20th century. The concept of sustainability has begun to be addressed and discussed by countries and global unions, as these problems in the ecosystem have increased steadily. Sustainability was mentioned for the first time in the World Charter for Nature document, which was adopted by the International Union for Conservation of Nature (IUCN) in 1982. In this charter, it was emphasized that the ecosystem, organisms, land, sea and atmosphere resources that people use should be managed to achieve the optimum sustainability in such a way not to jeopardize the integrity of the ecosystems and species (Tosun, 2009:1). Therefore, during this period, sustainability was considered as a problem of the industrial society, and it was evaluated within the framework of the human relationship with nature.

Within the historical process, sustainability has been associated with the concept of development and has achieved its current meaning. Sustainable Development was mentioned for the first time in the Brundtland Report (1987) by the United Nations World Environment and Development Commission with broad participation and expressed as “meeting today’s needs without compromising the ability of future generations to meet their own needs” (Bozlağan, 2004:2). With this report, being sustainable has started to be important in almost every field and become a system of thought that would be used effectively (Aktaş, 2017:59). In this context, while the consumption-based worldview that prevailed in the 20th century and proposed the utilization of the world resources as much as possible was gradually being abandoned, it gave its place to a sustainable worldview including the conservation of resources for next generations and more effective and efficient utilization of them. This was interpreted as sustainable development in the agenda of societies (Besler, 2009:1) and as institutional sustainability by micro-level businesses. Furthermore, it introduced the idea that not only the conservation of the ecosystem but also economic and social dimensions are needed for ensuring sustainability.

Nowadays, sustainability is examined with its economic, social, and environmental dimensions, which are called the triple-bottom-line developed by Elkington in 1997 (McKenzie, 2004:6). These three separate dimensions of the concept of the “triple-bottom-line” are actually related to each other and affect each other in various ways (Besler, 2009: 3). In other words, the prerequisite for ensuring sustainability in the long-term is to evaluate these three dimensions together.

The most important task in ensuring sustainable development falls to businesses. Especially, the facts that the needs of individuals, societies, and other organizations are met by businesses, businesses are the basic dynamics of the economy, and that the expectations of societies from businesses are changing and increasing make businesses prioritized in the subject of sustainability. While the conception and practices of sustainability in terms of businesses are called institutional sustainability, they also cause the acceptance of the idea that sustainable development cannot be achieved without businesses since they represent the productive resources of the economy (Sarıkaya and Kara, 2007:225). Furthermore, for businesses, institutional sustainability means understanding the risks and opportunities that current trends bring to businesses and reorganizing their operations, products, and services accordingly. Therefore, it is not possible for businesses that do not adopt sustainability to sustain their assets in the long term (Polat, 2017: 34). At this point, the “triple-bottom-line”, in other words, economic, social, and environmental sustainability, is addressed in terms of businesses.

Environmental sustainability refers to the recycling of resources, waste reduction, and population conservation during the production of businesses. However, the value chain management, which is included in economic sustainability, also affects environmental sustainability (Garbie, 2016:117). Briefly, environmental sustainability includes the natural environment such as water, energy, agriculture, forests, weather, and biodiversity (Weybrecht, 2010: 14). Social sustainability is examined as the social equality and includes human rights, peace, justice, gender equality, and cultural diversity (Weybrecht, 2010:14). In other words, the conditions of doing business within the enterprise, social dialogues, social security, and human resources development practices are social sustainability (Garbie, 2016:103). Economic sustainability encourages innovation, productivity, and creating wealth, and links social equality with environmental integrity principles (Bansal, 2005: 198-199). According to this, ensuring economic sustainability requires sensitivity in using resources in terms of economic activities because the world resources are limited (Yavuz, 2010: 65).

3. Analytic Hierarchy Process (AHP)

Decision makers and researchers in the social, economic and many fields face complicated decision problems that involve too many criteria, sub-criteria, and alternatives related to each other. One of the methods that can overcome risks and hazards in the complicated environment in which competition is experienced intensively nowadays, can cope with countless factors, enables taking decisions that are suitable for the purpose quickly, is understandable and easily applicable is the Analytic Hierarchy Process (AHP).

The Analytic Hierarchy Process (AHP), which was developed by Thomas L. Saaty (1980), is a multi-criteria decision-making method that organizes the problem encountered in an appropriate hierarchical structure and enables determining, measuring, and ranking priorities. The AHP begins the analysis process by organizing complicated problems in a system or under a roof that provides the ability to think more simply, rather than a complex way of thinking. Thus, in unstructured complex issues, the decision maker or problem solver helps the thinking process and allows the problem to be easily understood and systematically analyzed.

The AHP ensures the organization of information and judgments that will assist in making decisions, and it is aimed at producing arbitrated results by combining the expectation, feeling, perception, and logic under a single roof (Saaty, 2001: 2-13). In addition to these advantages, with its simplicity and power, it is widely used in many areas such as business world, politics, defence, R&D, where complexity, measurement and prioritization, estimation, and selection are required (Bhushan and Rai, 2004: 15).

The AHP method simply follows 4 steps (Tzeng and Huang, 2011:16):

1. The establishment of the hierarchical structure of the decision problem consisting of interrelated elements (goal, criterion, sub-criterion, alternative) (Figure 1)

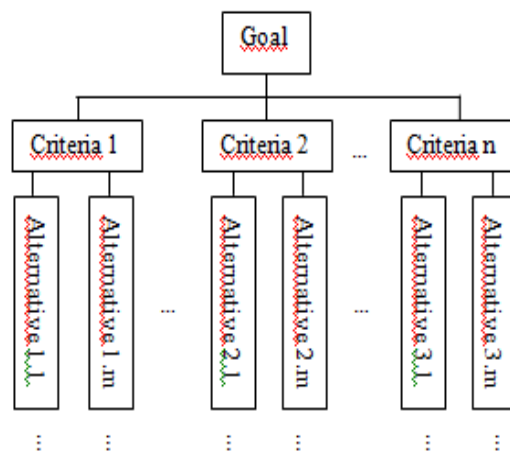


Figure 1. The AHP hierarchy structure

Source: Tzeng and Huang, 2011:16

2. The determination of the weights of the elements in the hierarchy with respect to each other and the creation of comparison matrices
3. The analysis of comparison matrices and calculation of the relative weights of the criteria
4. The combination of the relative weights and making the best alternative or strategy decision.

After the hierarchical structure of the problem (Figure 1) is established, $n \times n$ -dimension $A(a_{ij})$ paired comparison matrix [1] is arranged in accordance with the data obtained from experts for the estimation of the weights of the criterion/sub-criterion/alternatives (a_1, a_2, \dots, a_n) in the hierarchy.

$$A = [a_{ij}] = \begin{bmatrix} 1 & a_{12} & \Lambda & a_{1n} \\ 1/a_{12} & 1 & \Lambda & a_{2n} \\ M & M & O & M \\ 1/a_{1n} & 1/a_{2n} & \Lambda & 1 \end{bmatrix} \quad [1] \quad A = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \Lambda & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \Lambda & w_2/w_n \\ M & M & O & M \\ w_n/w_1 & w_n/w_2 & \Lambda & w_n/w_n \end{bmatrix} \quad [2]$$

In the matrix [1], a_{ij} , a_i , and a_j represent the quantitative estimations obtained from the experts on the paired comparisons of the criteria, and $a_{ij} = 1/a_{ji}$ ($i, j = 1, 2, \dots, n$). The matrix A consists of weights w_1, w_2, \dots, w_n that numerically represent the expert decisions of n criteria and the relationship between weights (w_i) and estimations (a_{ij}) should be $a_{ij} = w_i/w_j$ ($i, j = 1, 2, \dots, n$) so that the matrix A can be consistent (Wu et al., 2005:3) [2]. The relative importance weights of the criteria in the matrix are determined using the AHP ratio scale. The meaning of each numerical value in the scale is given in Table 1.

Table 1: AHP Paired Comparison Scale

Numerical importance level	1	3	5	7	9	2,4,6,8
Verbal estimations	Equally important	Slightly more important	Quite important	Very important	Extremely important	Intermediate values

Source: Saaty, 2006:215.

The matrix A reflects the importance of each criterion/sub-criterion/alternative compared to another. However, what is wanted to know is not their comparison with the others, but the self-weight value, that is, the priority vector of each criterion/sub-criterion/alternative. For this reason, the matrix must be normalized and the eigenvector, which is the largest eigenvalue and relative weights, must be calculated. Relative weights are obtained by $Aw = \lambda_{max} w$. λ_{max} is the largest eigenvalue of the matrix A, and w is the eigenvector associated with the eigenvalue. The value of $\lambda_{max} = n$ must always be the largest eigenvalue of the matrix A (Salmeron and Herrero, 2005:7).

The AHP provides an easy way for decision makers or problem solvers to ensure the consistency and control of the comparison. In paired comparisons, the logical consistency is measured by the Consistency Index (CI) and the Consistency Ratio (CR) [3] [4] (Wu et al., 2005:4):

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad [3] \quad CR = \frac{CI}{RI} \quad [4]$$

n in the inequality shows the size of the decision matrix, and RI shows the random index. The random index is the mean CI value of comparison matrices generated randomly by using the scale developed by Saaty (Table 2) (Davarpanah et al., 2016:10).

Table 2: Random Index (RI)

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.58

Source: Saaty, 2006:229.

According to Saaty, the consistency ratio value must be less than 0.1 in order for the analyses to be consistent. A high consistency ratio indicates that the opinions or estimations obtained in paired comparisons should be renewed (Bhushan and Rai, 2004:17).

4. The Examination of the Perspective of Kütahya Automotive Industry on Sustainability with the AHP

In this study, it is aimed to investigate the perspective of businesses producing in the automotive industry on sustainability and to reveal their perception of sustainability. The subject of sustainability, of which importance has gradually increased in recent years, and the automotive industry, one of the locomotive industries that has recently gained momentum in production in our country, constitute the main field of this study. In this preliminary study on the examination of the situation of our country in these subjects, the businesses that show productive activities in the automotive industry in Kütahya were included within the scope of the examination. Although there are not enough studies conducted on this subject in the literature, Salvado et al. (2015) presented a study that examines the indicators of sustainability and sustainability index that can be used in determining the performances of businesses together with the supply chains. In their study, in the determination of the indicators of sustainability, they used the triple-bottom-line approach (triple performance reporting-TBL) that is used for balancing the social, economic, and environmental needs, the G4 version of the reporting guide of the Global Reporting Initiative, and the ISO 14031 guideline (Salvado et al., 2015:2121). In this study, based on the indicators of sustainability model created by Salvado et al. (2015), the model was applied to five businesses producing in the automotive industry in Kütahya. One of the objectives is to compare the sustainability understanding and perspective of the automotive industry in Portugal and Turkey.

Although the dimensions or indicators of sustainability may vary from the perspective of the industry in which a business operates, some elements may be common to all sectors. In the Indicators of Sustainability model developed by Salvado et al. (2015), three criteria and fourteen sub-criteria were mentioned. The AHP structure of the model is presented in Fig.2.

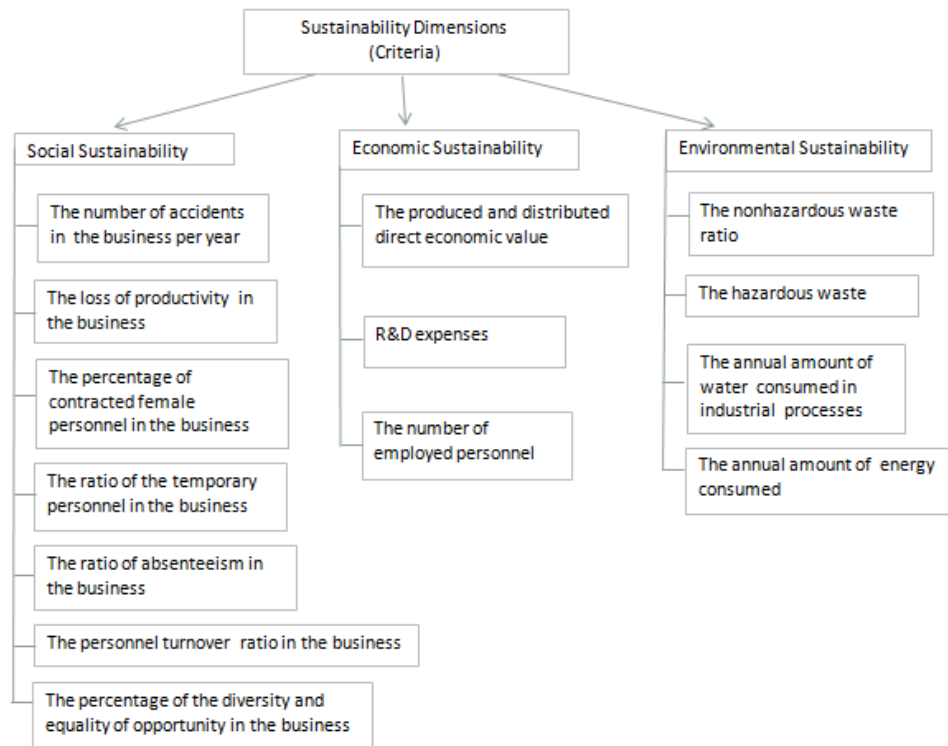


Figure 2: Sustainability Dimensions

The indicators of sustainability consist of 3 criteria, being Social Sustainability (7 sub-criteria, including the number of accidents in the business per year, the loss of productivity in the business, the percentage of contracted female personnel in the business, the percentage of temporary personnel in the business, the ratio of absenteeism in the business, the personnel turnover ratio in the business, the percentage of the diversity and equality of opportunity in the business), Economic Sustainability (3 sub-criteria, including the produced and distributed direct economic value, R&D expenses, the number of employed personnel), and Environmental Sustainability (4 sub-criteria, including the nonhazardous waste rate, hazardous waste rate, the annual amount of water consumed in industrial processes, the annual amount of energy consumed) and 3 criteria. In order to apply the AHP method in accordance with the hierarchy established according to the model based on, a questionnaire form was prepared. Questionnaires were applied to a total of 15 employees in the position of managers and decision makers of five businesses producing in the automotive industry in Kütahya Organized Industrial Zone. In the questionnaire, it was required to make a paired comparison of the criteria and subcriteria forming the hierarchy and to evaluate them in terms of their preference and importance levels. The data obtained from the questionnaire were analyzed and evaluated with the Super Decision program. In the Super Decision program, the analysis was started by converting the data into paired comparison matrices and then the AHP processing steps described in the third part were followed. After the evaluations, the priority vectors (weights) and priority ranks and consistency of the criteria and sub-criteria were obtained.

The results of the social, economic, and environmental criteria of the indicators of sustainability are presented in Table 3.

Table 3: Weights of the Indicators of Sustainability

Criteria	Priority Vector (Weights)	Priority Rank
Social Sustainability	0.26	3
Economic Sustainability	0.41	1
Environmental Sustainability	0.33	2
Total	1.000	
Consistency Ratio	0.096	

In the evaluations of the sustainability criteria of the businesses in the automotive industry in Kütahya, Economic Sustainability has a weight of 41% and is the criterion with the first priority. The Environmental Sustainability ranking second has a weight of 33% among the criteria. Social sustainability is concluded to be the criterion with the third priority with the weight of 26%. As the consistency ratio is obtained to be 0.096, it is observed that the condition of $CR < 0.10$ is also met. In the studies of Salvado et al. in 2015 in Portugal, Economic Sustainability was weighted by 66%, Environmental Sustainability by 21%, and Social Sustainability

by 13%. In both studies, while economic sustainability ranked first for businesses established for economic purposes, the similar ranking was obtained for other indicators.

The weights and rankings of the sub-criteria of the Social, Economic, and Environmental Sustainability criteria are presented in Table 4.

Table 4: Weights of the Social, Economic, and Environmental Sustainability Sub-Criteria

Social Sustainability Sub-Criteria	Priority Vector (Weights)	Priority Rank
The number of accidents in the business per year	0.33	1
The productivity loss in the business	0.14	4
The number of contracted female personnel in the business	0.07	6
The percentage of the temporary personnel in the business	0.03	7
The ratio of absenteeism in the business	0.17	3
The personnel turnover ratio in the business	0.18	2
The percentage of the diversity and equality of opportunity in the business	0.08	5
Total	1.000	
Consistency Ratio	0.037	
Economic Sustainability Sub-Criteria	Priority Vector (Weights)	Priority Rank
The produced and distributed direct economic value	0.50	1
R&D expenses	0.26	2
The number of employed personnel	0.24	3
Total	1.000	
Consistency Ratio	0.000	
Environmental Sustainability Sub-Criteria	Priority Vector (Weights)	Priority Rank
The nonhazardous waste ratio	0.08	4
The hazardous waste ratio	0.36	1
The annual amount of water consumed in industrial processes	0.26	3
The annual amount of energy consumed	0.30	2
Total	1.000	
Consistency Ratio	0.022	

In Table 4, in which the sub-criteria of sustainability are examined, the sub-criterion of “The number of accidents in the business per year” has a weight of 33% and is the indicator of the social sustainability ranking first. “The personnel turnover ratio” with the weight of 18% and “The ratio of absenteeism in the business” with the weight of 17% were concluded to be the second and third social sustainability sub-criteria very close to each other. In the studies of Salvado et al., “The number of accidents in the business per year” was also the first sub-criterion, and differently from the result of this study, “The percentage of the diversity and equality of opportunity in the business” was obtained to be the second sub-criterion. When the economic sustainability sub-criteria are examined, the sub-criterion of “The produced and distributed direct economic value” has a first priority level (50%) higher than the others. “R&D expenses” is in the second rank, and “The number of employed personnel” is in the third rank, and they have close percentages. The consistency ratio is CR=0.00, indicating that the evaluations are reliable and consistent. In their studies, Salvado et al. obtained results with the same ranking for the economic sustainability sub-criteria. In the field of environmental sustainability, the sub-criterion of “The hazardous waste ratio” ranks first with a weight of 36% and the sub-criterion of the “Annual amount of energy consumed” ranks second with a weight of 30%. The “Annual amount of water consumed in industrial processes” is at the third priority level (with a weight of 26%) and “The nonhazardous waste ratio” is the sub-criterion with the least importance level. In the study of Salvado et al., it was observed that while the hazardous and non-hazardous waste ratios were in the first place with the ratios very close to each other, the sub-criteria of the annual amount of water consumed in industrial processes and the annual amount of energy consumed were also close to each other in a similar way.

5. Conclusion

In this study, which has studied sustainability, of which importance has gradually increased in recent years in the government, society, industry, and in many areas, it has been aimed to investigate the situation of Turkey in this area. Sustainability, which can be considered as one of the professional business activities, has been examined in the businesses producing in Kütahya automotive industry as a preliminary study.

Although it may have different perspectives in different fields of activity, its basic and common points were

examined, and the perspective of the automotive industry on sustainability was examined with the AHP method. According to the results of the analysis, economic sustainability is perceived as the most important indicator of sustainability and economic sustainability is followed by environmental and social sustainability, respectively. The number of accidents in the business per year was the criterion with the highest weight in terms of social sustainability, it was the produced and distributed direct economic value in terms of economic sustainability, and it was the hazardous waste ratio in terms of environmental sustainability. Similar results were obtained in the studies of Salvado et al. (2015).

It is observed from the findings obtained that businesses in the automotive industry, which is profit-oriented and is also among the locomotive sectors in the country, aim to provide continuity of their assets by creating higher economic value in the intense competitive environment. It is believed that it is needed to raise also the awareness of businesses of social and environmental sustainability, which will have a leverage effect in terms of their contribution to economic sustainability.

It is thought that this study will be useful for the adoption and raising the awareness of sustainability that has become a purpose focused and acknowledged by governments and industries all over the world nowadays. However, it is thought that the sample of Kütahya automotive industry could be expanded and more reliable results could be obtained by carrying out a study on a sample that includes more businesses in the industry. Comparisons of different industries with a great contribution to the national economy can be made, and similar and different perspectives of industries can be compared in terms of sustainability. Furthermore, the criteria weights and rankings can be compared using the analytic network process, in which the horizontal relationships of the hierarchical elements are discussed, and different methods along with the AHP method. It should not be forgotten that more studies to be conducted in this field will positively affect the awareness in terms of the society and country.

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